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DEPARTMENT OF THE INTERIOR

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BUREAU OF MINES

VAN. H. MANNING, DIRECTOR

PREPAREDNESS CENSUS
OF
MINING ENGINEERS, METALLURGISTS
AND CHEMISTS

BY

ALBERT H. FAY

...



WASHINGTON
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PREFACE.

The Bureau of Mines, at the request of the Council of National Defense, has taken a census of mining engineers, metallurgists, and chemists, the results of which are embodied in this paper. The reasons for taking this census are obvious. In the conduct of war to-day chemists and engineers play a far greater rôle than ever before. The products of the mines, furnaces, factories, and chemical plants are being so rapidly consumed that the highest possible skill is required to keep pace with the destruction everywhere apparent. In the organization of a great army, many classes of specialists are needed, and the problem is to get the best qualified man for each place. Men with a knowledge of sanitation are essential to the health of the soldiers at the various training camps. Men with an intimate knowledge of pyrotechnics find a place in the manufacture and use of certain signal devices; telephone and telegraph operators are essential for systems of rapid communication, without which valuable time may be lost; coal and iron are absolute necessities for the manufacture of arms and munitions, and many naval vessels can not be operated without the use of petroleum as a fuel, and motor trucks are useless without gasoline, or of spirits obtained with greater difficulty.

Mining engineers, under military control, may be of the greatest assistance in a military way in planning and directing sapping operations; in the digging of trenches; in the erection of special supports such as concrete and steel for trenches, dugouts, and tunnels behind the lines, and in planning systems of ventilation and drainage for such excavations; in rehabilitating or redeveloping wrecked coal and iron mines taken from the enemy; and in increasing the output of minerals for military uses in other districts. Further, the experience of some mining engineers in the use of oxygen mine rescue apparatus might be invaluable in the exploration of underground saps or dugouts filled with poisonous gases. It is on the theory of being able to place the right man in the right place at the right time that this census has been conducted.

The work of conducting this census was carried out in cooperation with the American Institute of Mining Engineers, and the American Chemical Society. A circular letter was addressed to approximately 5,000 members of the American Institute of Mining Engineers and 9,000 members of the American Chemical Society. This letter requested that each recipient fill out and return a card accompanying the letter and make himself a committee of one to see that every

chemist and engineer of his acquaintance likewise filled out a card. The letter contained the statement that additional cards would be furnished on request. The number of replies received by the bureau represented approximately 7,500 men engaged in the mining industry and 15,000 in the chemical industry.

As the Bureau of Mines wishes to keep its lists up to date, the engineers and chemists are requested to advise the Bureau of Mines of any change of address. In order to avoid unnecessary correspondence and delay, it is necessary that the bureau have this information at hand when selecting technical men for any special duty.

VAN. H. MANNING,
Director.

CENSUS OF MINING ENGINEERS, METALLURGIST, AND CHEMISTS.

By ALBERT H. FAY.

INTRODUCTION.

The census of mining engineers and metallurgists conducted by the Bureau of Mines resulted in the receipt of replies from 7,500 men engaged in mining and from 15,000 men engaged in the various chemical industries. These 22,500 names have been classified according to the character of the work in which each writer claims proficiency, so that the bureau now has available an extensive classification from which selections for certain positions may be made. The classification includes not only specialists in various branches of chemistry and mining, but includes as well a classified list of men who have had experience in foreign countries. It is not the purpose of this census to enable the bureau to act as a clearing house for technical men in obtaining commercial positions. Should any of the industrial plants that are engaged on Government contracts desire the services of special men, a request may be made to the Bureau of Mines, stating the type of men needed, and the bureau will endeavor to furnish such names from its classified list.

CLASSIFICATION OF CENSUS RETURNS.

In the classification of the mining engineers and chemists no attention was paid to any particular group in which the experience of the individual did not amount to more than one year, except where it was known that there were only a few experts in a certain branch. In the classification by groups the total number will not necessarily agree with the total number of mining engineers or chemists registered, by reason of the fact that for many men an experience of more than one year was shown under several items, so that as many as five or six individual cards were made out for one engineer or chemist. The total number of index cards made out for the chemists was approximately 28,000, or an average of 2 for each person, whereas the number of index cards made out for the mining engineers was 30,000, or 4 for each engineer. The list of chemists and engineers having had

experience abroad includes only the names of those who have spent more than one year in a foreign land.

The census returns will be followed by postal inquiries as soon as the selective draft has been completed and the men know their military status. This questionnaire will ask each man in the Government service to give his new address, the name of the department, branch, or bureau, regiment, or company with which he is connected, and his official title. The bureau will then be able to reclassify all experts and show who is in the Federal service. Then, should the War Department call on the bureau at any time for the names of men in certain lines of mining or chemistry, it can select from the postal-card returns the names of men already in the military service who could be transferred to a regiment or a place where their work would be of greater benefit than in the line as privates.

MINING ENGINEERS.

The table following shows 7,500 mining engineers classified according to their mining and metallurgical experience. The miscellaneous group of 1,615 includes 467 consulting mining engineers; 312 geologists; 121 professors of mining, metallurgy, and geology; and 129 men not engaged in engineering work but holding administrative positions, such as secretaries, treasurers, or presidents of mining corporations. There are also a number of efficiency, safety, and fuel engineers, inspectors, accountants, editors, and sales and purchasing agents.

Classification of mining engineers according to mining and metallurgical experience.

MINING.

1. Construction (building).....	1,770
2. Construction (machinery).....	735
3. Development work.....	2,325
4. Designing and drafting.....	945
5. Dike and levee construction.....	98
6. Drainage and pumping.....	563
7. Dredging.....	115
8. Erection of machinery.....	1,050
9. Explosives (mine and quarry).....	863
10. Hydraulic mining.....	173
11. Prospecting (with boring machines).....	840
12. Quarrying.....	165
13. Steam-shovel mining.....	330
14. Surveying, mine or topographic.....	1,935
15. Tunnel and shaft work under compressed air.....	83
16. Underground mining.....	(a)
17. Miscellaneous.....	1,615

^a No classification attempted for this group as every one with any mining experience has had some underground work.

ORE REDUCTION.

25. Assaying.....	718
26. Ore concentration.....	1,038
27. Metallurgy, general.....	248
27a. Alloys, ferrous.....	66
27b. Alloys, nonferrous.....	46
27c. Aluminum and magnesium.....	18
27d. Antimony, bismuth, and cadmium.....	21
27e. Chromium and manganese.....	23
27f. Copper.....	540
27g. Gold and silver.....	735
27h. Iron and steel.....	450
27i. Lead.....	300
27j. Mercury.....	51
27k. Nickel and cobalt.....	30
27l. Platinum metals.....	26
27m. Radium and uranium.....	14
27n. Silicon and titanium.....	7
27o. Zinc.....	255
27p. Other metallurgy.....	90

The table following shows the mining engineers classified according to the different kinds of mines in which they have had actual mining experience. Of course there is considerable duplication in that many of the engineers may be carded under two, three, or even half a dozen different groups. The "other minerals" classified in this group include bauxite, antimony, clays, sulphur, and a number of other minor minerals.

Engineers classified by kinds of mines.

Coal.....	1,795	Nickel.....	18
Copper.....	1,758	Petroleum.....	1,045
Gold and silver.....	1,840	Phosphate.....	27
Iron.....	842	Pyrite.....	19
Lead and zinc.....	1,384	Rare metals.....	55
Manganese.....	37	Tin.....	34
Mercury.....	35	Tungsten.....	57
Molybdenum.....	20	Other minerals.....	303

PETROLEUM INDUSTRY.

On account of the importance of petroleum and its products for fuel and other purposes, the Bureau of Mines decided to prepare a classified list of men engaged in the petroleum industry. A circular letter was addressed to the principal operating companies, in which they were asked to give the names of their managers, drillers, pump men, transportation engineers, chemists, and refiners. The companies responded promptly by furnishing the required lists, and to each name thereon was sent one of the registration cards for the individual to fill out and return to the bureau. As a result of this

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circular letter to the operators, together with the names obtained from the regular engineers' and chemists' lists, the following classification of men in the petroleum industry has been made possible:

Men engaged in the petroleum industry.

Administrative.....	392
Geologists.....	92
Drillers.....	405
Pump men.....	68
Transportation engineers.....	88
Chemists and refiners.....	769

CHEMISTS.

The accompanying table shows the 15,000 chemists classified according to the various industrial groups. The miscellaneous group of 1,130 includes 240 men not actually engaged in laboratory work, but holding administrative positions such as secretaries, presidents, and treasurers of chemical companies. It also includes 157 leather chemists, 116 research chemists, a number of dentists, editors, physicians, chemical engineers, and consulting chemists.

Chemists classified by chief industrial groups.

1. Acids, alkalies, and salts.....	1,405
2. Alcohol and acetone.....	339
3. Ammonia oxidation.....	81
4. Analytical chemistry.....	3,808
5. Barium compounds.....	208
6. Cement and lime.....	584
7. Coal, gas, tar, and coke.....	1,294
8. Dyes and textiles.....	775
9. Electrochemistry.....	769
10. Explosives (high).....	962
11. Explosives (black powder).....	150
12. Fats and soaps.....	834
13. Fertilizers.....	844
14. Foods.....	1,619
15. Glass and ceramics.....	262
16. Inorganic chemicals.....	532
17. Nitrogen (synthetic).....	128
18. Organic chemicals (other than 2).....	888
19. Paints and varnish.....	577
20. Petroleum and asphalt.....	769
21. Pharmaceuticals.....	983
22. Pyrotechnics.....	42
23. Rubber and allied substances.....	494
24. Sugar, starch, and gums.....	592
25. Water, sewage, and sanitation.....	1,035
26. Wood products.....	368
27. Metallurgical chemistry.....	494
27a. Alloys, ferrous.....	323
27b. Alloys, nonferrous.....	360

27. Metallurgical chemistry—Continued.

27c.	Aluminum and magnesium.....	127
27d.	Antimony, bismuth, and cadmium.....	54
27e.	Chromium and manganese.....	82
27f.	Copper.....	379
27g.	Gold and silver.....	337
27h.	Iron and steel.....	1,415
27i.	Lead.....	209
27j.	Mercury.....	25
27k.	Nickel and cobalt.....	68
27l.	Platinum metals.....	75
27m.	Radium and uranium.....	99
27n.	Silicon and titanium.....	89
27o.	Zinc.....	255
27p.	Other metallurgy.....	126
28.	Professors and instructors.....	1,285
29.	Miscellaneous.....	1,130

The following table shows the number of chemists and mining engineers who reported experience in foreign countries:

Mining engineers and chemists having experience in principal foreign countries.

Country.	Mining engineers.	Chemists.
Africa.....	74	13
Australasia.....	46	10
Austria-Hungary.....	7	24
Canada.....	384	203
Central America.....	74	15
Cuba.....	68	60
Europe:		
Belgium.....	6	6
Denmark.....	1	10
France.....	23	38
Great Britain.....	116	117
Germany.....	61	231
Holland.....	2	10
Italy.....	5	11
Norway-Sweden.....	19	21
Russia.....	25	30
Spain.....	7	5
Switzerland.....	8	18
Others.....	22	10
Not specified.....	101	171
Far East (including Philippines).....	105	80
Greenland.....	3	
India.....	11	
Mexico.....	679	117
Newfoundland.....	7	
South America.....	241	34
West Indies.....	17	32

METALLURGISTS.

Although the bureau's schedule was sent primarily to mining engineers and chemists, the questions relating to metallurgy were identical, and were so arranged that any one with experience in metallurgy could find the proper place to indicate the line along which he had worked. The table following shows the number of metallurgists, by principal groups, as obtained from the returns of the mining engineers and chemists.

Number of metallurgists, by groups.

Group.	Mining engineers.	Chemists.	Total.
26. Ore concentration.....	1,038		1,038
27. Metallurgy, general.....	248	494	742
27a. Alloys, ferrous.....	66	323	389
27b. Alloys, nonferrous.....	46	360	406
27c. Aluminum and magnesium.....	18	127	145
27d. Antimony, bismuth, and cadmium.....	21	54	75
27e. Chromium and manganese.....	23	82	105
27f. Copper.....	540	379	919
27g. Gold and silver.....	735	337	1,072
27h. Iron and steel.....	450	1,415	1,865
27i. Lead.....	300	209	509
27j. Mercury.....	51	25	76
27k. Nickel and cobalt.....	30	68	98
27l. Platinum metals.....	26	75	101
27m. Radium and uranium.....	14	99	113
27n. Silicon and titanium.....	7	89	96
27o. Zinc.....	255	255	510
27p. Other metallurgy.....	90	126	216

FORMS USED IN TAKING CENSUS.

Upon the request of the Council of National Defense, the Bureau of Mines drafted the following letter to the members of the American Institute of Mining Engineers:

TO AMERICAN MINING ENGINEERS:

By request of the Council of National Defense, the Bureau of Mines, in cooperation with the American Institute of Mining Engineers, will prepare a classified list of the mining engineers and metallurgists of the United States. Data covering the qualifications, experience, and skill of each engineer are desired to determine the line of duty in which he can best serve the country in time of need.

European experience has shown that nothing is more important in time of national emergency than a knowledge of the qualifications and experience of expert technical men. It is, therefore, important, especially at present, that this information be available in the United States.

You are accordingly requested as a patriotic duty not only to fill out the card which you will receive herewith, but to see that every engineer and metallurgist within your acquaintance receives one and does likewise. Additional cards will be furnished upon request. You will please check only those subjects in which you are expert, especially where you have had actual mining or metallurgical experience. Please return the card promptly, using the inclosed penalty envelope. The information received will be carefully classified, carded, and indexed. Your prompt response to this matter will be very much appreciated.

Very truly yours,

VAN. H. MANNING,
Director, Bureau of Mines.

PHILIP N. MOORE,
President, American Institute of Mining Engineers.

A similar letter, signed jointly by the Director of the Bureau of Mines and Julius Stieglitz, president of the American Chemical Society, was addressed to the members of the American Chemical Society.

The forms used in taking the census follow; they show the character of the information collected by the bureau regarding each individual engineer or chemist.

Form sent to mining engineers.

DEPARTMENT OF THE INTERIOR—BUREAU OF MINES.

(In cooperation with the Council of National Defense and the American Institute of Mining Engineers.)

Please fill out replies to the following queries and return as promptly as possible to the Bureau of Mines, Washington, D. C.:

1. Name.....
2. Present address.....
3. Permanent address.....
4. Date of birth.....
5. Where born?.....
6. Where were your parents born?.....
7. Married or single?.....
8. Number of dependents for whose support you are wholly responsible, ".....; partly responsible.....
9. Are you an American citizen?.....
10. If naturalized, give date.....
11. Health..... Eyesight..... Hearing.....
Bodily disability, nature of.....
12. Institution where graduated.....
13. Date of graduation.....
14. Degree.....
15. What foreign language do you speak?.....
16. In what countries have you had experience, and how much?.....
17. Technical societies of which you are a member.....

EXPERIENCE.

Date.	18. Please list positions held during the past five years, naming special duties of each.
1912 to	
1917	Present position, occupation, and employer.....

- Please **underline** items in which you are **proficient**. Fill in number years' experience in any of the branches listed below.

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Mining and metallurgy.	Experience in years as—		
	Fore- man.	Engi- neer	Superin- tendent or manager.
ORE REDUCTION.			
25. Assaying.....			
26. Ore concentration.....			
27. Metallurgy:			
27a. Alloys, ferrous.....			
27b. Alloys, nonferrous.....			
27c. Aluminum and magnesium.....			
27d. Antimony, bismuth, and cadmium.....			
27e. Chromium and manganese.....			
27f. Copper.....			
27g. Gold and silver.....			
27h. Iron and steel.....			
27i. Lead.....			
27j. Mercury.....			
27k. Nickel and cobalt.....			
27l. Platinum metals.....			
27m. Radium and uranium.....			
27n. Silicon and titanium.....			
27o. Zinc.....			

Form sent to chemists.

DEPARTMENT OF THE INTERIOR—BUREAU OF MINES.

(In cooperation with the Council of National Defense and the American Chemical Society.)

Please fill out replies to the following queries and return as promptly as possible to the Bureau of Mines, Washington, D. C.:

1. Name.....
2. Present address.....
3. Permanent address.....
4. Date of birth.....
5. Where born?.....
6. Where were your parents born?.....
7. Married or single?.....
8. Number of dependents for whose support you are wholly responsible, ...; partly responsible
9. Are you an American citizen?.....
10. If naturalized, give date.....
11. Health..... Eyesight..... Hearing..... Bodily disability, nature of
12. Institution where graduated.....

17. Technical societies of which you are a member.

EXPERIENCE.

Date.	18. Please list positions held during the past five years, naming special duties of each.
1912 to	.
	.
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	.
1917.	Present position, occupation, and employer:
.	.

19. Publications: Reports or papers, give titles and where published, or indicate the fields to which you have contributed.
20. In case of emergency, how and where, in your opinion, could you be of most service to this country?
21. Present military connections.

Please underline items in which you are **proficient**. Fill in number of years experience in laboratory or works.

Chemical industries.	Experience.	
	Laboratory (years).	Works (years).
1. Acids, alkalis, and salts.....		
2. Alcohol and acetone.....		
3. Ammonia oxidation.....		
4. Analytical chemistry.....		
5. Barium compounds.....		
6. Cement and lime.....		
7. Coal, gas, tar, and coke.....		
8. Dyes and textiles.....		
9. Electrochemistry.....		
10. Explosives (high).....		
11. Explosives (black powder).....		
12. Fats and soaps.....		
13. Fertilizers.....		
14. Foods.....		
15. Glass and ceramics.....		
16. Inorganic chemicals.....		
17. Nitrogen (synthetic).....		
18. Organic chemicals (other than 2).....		
19. Paints and varnish.....		
20. Petroleum and asphalt.....		
21. Pharmaceuticals.....		
22. Pyrotechnics.....		
23. Rubber and allied substances.....		
24. Sugar, starch, and gums.....		
25. Water, sewage, and sanitation.....		
26. Wood products.....		
27. Metallurgical chemistry:		
27a. Alloys, ferrous.....		
27b. Alloys, nonferrous.....		
27c. Aluminum and magnesium.....		
27d. Antimony, bismuth, and cadmium.....		
27e. Chromium and manganese.....		
27f. Copper.....		
27g. Gold and silver.....		
27h. Iron and steel.....		
27i. Lead.....		
27j. Mercury.....		
27k. Nickel and cobalt.....		
27l. Platinum metals.....		
27m. Radium and uranium.....		
27n. Silicon and titanium.....		
27o. Zinc.....		

COOPERATION WITH CHEMISTRY COMMITTEE OF NATIONAL RESEARCH COUNCIL.

In order to furnish certain information—the names of men available for research work—to the chemistry committee of the National Research Council the following letter and questions were added to the regular chemist's form. When these forms were received at the office of the bureau they were detached and forwarded to Dr. Marston Taylor Bogert, chairman of the committee.

DEPARTMENT OF THE INTERIOR—BUREAU OF MINES.

(In cooperation with the chemistry committee of the National Research Council.)

To assist the chemistry committee of the National Research Council in its efforts to prepare for the use of the Government a classified list of our chemical investigators, it is requested that you fill out the reverse of this card. As the matter is urgent, it is hoped that you will give it your careful attention.

Very truly yours,

MARSTON TAYLOR BOGERT,
Chairman Chemistry Committee, National Research Council.

Name.....
Address.....

Are you at present engaged in original research work in chemistry? If so, state lines of work in which you are interested.

Are you willing to undertake original work in chemistry to aid the Government in the solution of problems affecting the security and defense of our country?.....

If so, in what fields of chemical research are you best qualified by experience and training to work, or along what lines would you prefer to work

About how much time per week do you believe that you could give to such work?

REQUESTS FOR INFORMATION CONCERNING CENSUS.

After the work of the census had gotten well under way the bureau received numerous requests for information concerning employment, military service, etc., so that it was necessary to prepare the following letter:

DEAR SIR: In reply to your recent letter concerning registration with this bureau as a technical man:

1. Registration with the bureau does not guarantee employment in the Government service.
2. It does not eliminate one from the possibility of being conscripted for military service.
3. The bureau is not in a position to offer advice concerning enlistment in the Engineers' Reserve Corps. This is a personal matter that must be decided by the individual.
4. The census list prepared by the bureau is for the purpose of procuring the names of experienced men, so that, should the Government require the services of a special man or group of men, selection can be made from this classified list.

Very truly yours,

VAN. H. MANNING, *Director.*

FOLLOW-UP POSTAL CARD.

In order to keep in touch with each man with respect to his Government service the following card was sent to all registrants. Those who may not have received a card are requested to comply with this request.

DEAR SIR: As the Bureau of Mines wishes to keep its lists of engineers and chemists up to date, you are asked, IF NOW IN ANY BRANCH OF THE GOVERNMENT SERVICE, to fill out and return the attached card. Also, the bureau will appreciate your keeping it advised of any change of address. In order to avoid unnecessary correspondence and delay it is necessary that the bureau have this information at hand when selecting technical men for any special duty.

Very truly yours,

VAN. H. MANNING, *Director.*

Name.....
 Address.....
 Government service, department.....
 Branch or bureau.....
 Regiment.....
 Company.....
 Official title.....

